WE CLAIM:

1. A lipopeptide comprising a polypeptide conjugated to one or more lipid moieties wherein:

(i) said polypeptide comprises an amino acid sequence that comprises:

(a) the amino acid sequence of a T helper cell (Th) epitope and the amino acid sequence of a B cell epitope, wherein said amino acid sequences are different; and

(b) one or more internal lysine residues or internal lysine analog residues for covalent attachment of each of said lipid moieties via the epsilon-amino group or terminal side-chain group of said lysine or lysine analog; and

(ii) each of said one or more lipid moieties is covalently attached to an epsilon-amino group of said one or more internal lysine residues or to a terminal side-chain group of said one or more internal lysine analog residues.

2. The lipopeptide of claim 1 wherein the lipid is attached to the epsilon-amino group of a lysine residue.

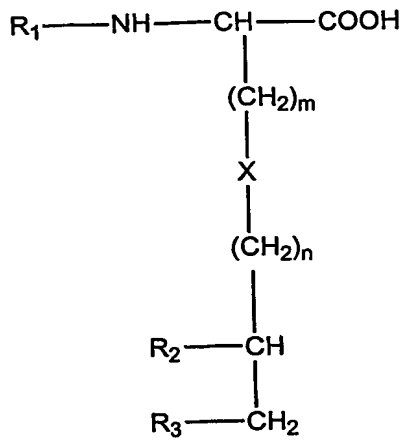
3. The lipopeptide of claim 1 or 2 wherein the internal lysine residue to which a lipid moiety is attached is positioned between the Th epitope and the B cell epitope.

4. The lipopeptide of claim 1 or 2 wherein the internal lysine residue to which a lipid moiety is attached is positioned within the Th epitope.

5. The lipopeptide of claim 1 or 2 comprising two lipid moieties.

6. The lipopeptide of claim 5 wherein an internal lysine residue to which a lipid moiety is attached is positioned between the Th epitope and the B cell epitope and an internal lysine residue to which a lipid moiety is attached is positioned within the Th epitope.

7. The lipopeptide according to any one of claims 1 to 6 wherein the lipid moiety has a structure of General Formula (VII):



wherein:

(i) X is selected from the group consisting of sulfur, oxygen, disulfide (-S-S-), and methylene (-CH_2-), and amino (-NH-);

(ii) m is an integer being 1 or 2;

(iii) n is an integer from 0 to 5;

(iv) R_1 is selected from the group consisting of hydrogen, carbonyl (-CO-), and R'-CO- wherein R' is selected from the group consisting of alkyl having 7 to 25 carbon atoms, alkenyl having 7 to 25 carbon atoms, and alkynyl having 7 to 25 carbon atoms, wherein said alkyl, alkenyl or alkynyl group is optionally substituted by a hydroxyl, amino, oxo, acyl, or cycloalkyl group;

(v) R_2 is selected from the group consisting of R'-CO-O-, R'-O-, R'-O-CO-, R'-NH-CO-, and R'-CO-NH-, wherein R' is selected from the group consisting of alkyl having 7 to 25 carbon atoms, alkenyl having 7 to 25 carbon atoms, and alkynyl having 7 to 25 carbon atoms, wherein said alkyl, alkenyl or alkynyl group is optionally substituted by a hydroxyl, amino, oxo, acyl, or cycloalkyl group; and

(vi) R_3 is selected from the group consisting of R'-CO-O-, R'-O-, R'-O-CO-,

R'-NH-CO-, and R'-CO-NH-, wherein R' is selected from the group consisting of alkyl having 7 to 25 carbon atoms, alkenyl having 7 to 25 carbon atoms, and alkynyl having 7 to 25 carbon atoms, wherein said alkyl, alkenyl or alkynyl group is optionally substituted by a hydroxyl, amino, oxo, acyl, or cycloalkyl group

and wherein each of R_1, R_2 and R_3 are the same or different.

8. The lipopeptide of claim 7 wherein X is sulfur; m and n are both 1; R_1 is selected from the group consisting of hydrogen, and R'-CO-, wherein R' is an alkyl group having 7 to 25 carbon atoms; and R_2 and R_3 are selected from the group consisting of R'-CO-O-, R'-O-, R'-O-CO-, R'-NH-CO-, and R'-CO-NH-, wherein R' is an alkyl group having 7 to 25 carbon atoms.

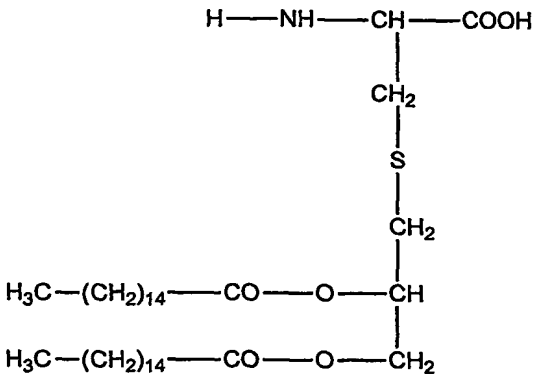
9. The lipopeptide of claim 8 wherein R' is selected from the group consisting of: palmitoyl, myristoyl, stearoyl, lauroyl, octanoyl, and decanoyl.

10. The lipopeptide of claim 9 wherein R' is selected from the group consisting of: palmitoyl, stearoyl, lauroyl, and octanoyl, and decanoyl.

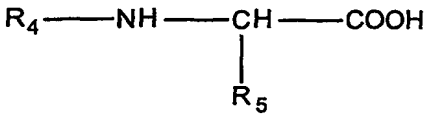
11. The lipopeptide according to any one of claims 7 to 10 wherein the lipid is contained within a lipoamino acid moiety selected from the group consisting of: Pam_2Cys, Pam_3Cys, Ste_2Cys, Lau_2Cys, and Oct_2Cys.

12. The lipopeptide according to claim 11 wherein the lipoamino acid moiety is selected from the group consisting of Pam_2Cys, Ste_2Cys, Lau_2Cys, and Oct_2Cys.

13. The lipopeptide according to claim 11 wherein the lipoamino acid moiety has the structure of Formula (II):



14. The lipopeptide according to any one of claims 1 to 6 wherein the lipid moiety has the following General Formula (VIII):



wherein:

(i) R_4 is selected from the group consisting of: (i) an alpha-acyl-fatty acid residue consisting of between about 7 and about 25 carbon atoms; (ii) an alpha-alkyl-beta-hydroxy-fatty acid residue; (iii) a beta-hydroxy ester of an alpha-alkyl-beta-hydroxy-fatty acid residue; and (iv) a lipoamino acid residue; and

(ii) R_5 is hydrogen or the side chain of an amino acid residue.

15. The lipopeptide according to any one of claims 1 to 14 wherein the lipid moiety is separated from the peptide moiety by a spacer.

16. The lipopeptide of claim 15 wherein the spacer comprises arginine, serine or 6-aminohexanoic acid.

17. The lipopeptide of claim 15 or 16 wherein the spacer consists of a serine homodimer.

18. The lipopeptide of claim 15 or 16 wherein the spacer consists of an arginine homodimer.

20. The lipopeptide of claim 15 or 16 wherein the spacer consists of 6-aminohexanoic acid.

21. The lipopeptide accord to any one of claims 1 to 20 wherein the internal lysine or internal lysine analog is nested within a synthetic amino acid sequence having low immunogenicity.

22. The lipopeptide according to any one of claims 1 to 21 wherein the T-helper epitope is a T-helper epitope of influenza virus haemagglutinin or a T-helper epitope of canine distemper virus F (CDV-F) protein.

23. The lipopeptide of claim 22 wherein the a T-helper epitope of influenza virus haemagglutinin comprises the amino acid sequence set forth in SEQ ID NO: 1 or SEQ ID NO: 18.

24. The lipopeptide of claim 23 wherein the a T-helper epitope of influenza virus haemagglutinin comprises the amino acid sequence set forth in SEQ ID NO: 1.

25. The lipopeptide of claim 22 wherein the T-helper epitope of CDV-F protein comprises the amino acid sequence set forth in SEQ ID NO: 24.

26. The lipopeptide according to any one of claims 1 to 25 wherein the B cell epitope is from an immunogenic protein, lipoprotein, or glycoprotein of a virus.

27. The lipopeptide according to any one of claims 1 to 25 wherein the B cell epitope is from an immunogenic protein, lipoprotein, or glycoprotein of a prokaryotic organism.

28. The lipopeptide according to claim 27 wherein the B cell epitope is from the M protein of Group A streptococcus.

29. The lipopeptide of claim 28 wherein the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 101.

30. The lipopeptide according to any one of claims 1 to 25 wherein the B cell epitope is from an immunogenic protein, lipoprotein, or glycoprotein of a eukaryotic organism.

31. The lipopeptide according to claim 30 wherein the eukaryotic organism is a parasite.

32. The lipopeptide according to claim 30 wherein the eukaryotic organism is a mammal.

33. The lipopeptide according to claim 32 wherein the B cell epitope is from a peptide hormone of a mammal.

34. The lipopeptide according to claim 33 wherein the peptide hormone is a digestive hormone or a reproductive peptide hormone.

35. The lipopeptide according to claim 34 wherein the digestive hormone is gastrin or pentagastrin.

36. The lipopeptide according to claim 35 comprising the amino acid sequence set forth in SEQ ID NO: 102 or SEQ ID NO: 113.

37. The lipopeptide according to claim 34 wherein the reproductive hormone is luteinising hormone-releasing hormone (LHRH) or a fragment thereof.

38. The lipopeptide according to claim 31 comprising the amino acid sequence set forth in SEQ ID NO: 2 or SEQ ID NO: 3 or SEQ ID NO: 4.

39. The lipopeptide according to any one of claims 1 to 38 wherein the polypeptide comprises an amino acid sequence selected from the group consisting of:

a polypeptide comprising an amino acid sequence selected from the group consisting of:

(xv) GALNNRFQIKGVELKSEHWSYGLRPG (SEQ ID NO: 5);
(xvi) GALNNRFQIKGVELKSKEHWSYGLRPG (SEQ ID NO: 7);
(xvii) KLIPNASLIENCTKAELKHWSYGLRPG (SEQ ID NO: 9);
(xviii) KLIPNASLIENCTKAELKGLRPG (SEQ ID NO: 13);
(xix) KLIPNASLIENCTKAELHWSYGLRPG (SEQ ID NO: 103);
(xx) KLIPNASLIENCTKAELGLRPG (SEQ ID NO: 104);
(xxi) KLIPNASLIENCTKAELKQAEDKVKASREAKKQVEKALEQLEDKVK (SEQ ID NO: 105);
(xxii) KLIPNASLIENCTKAELKKQAEDKVKASREAKKQVEKALEQLEDKVK (SEQ ID NO: 106);
(xxiii) GALNNRFQIKGVELKSKQAEDKVKASREAKKQVEKALEQLEDKVK (SEQ ID NO: 107);
(xxiv) GALNNRFQIKGVELKSKKQAEDKVKASREAKKQVEKALEQLEDKVK (SEQ ID NO: 108);
(xxv) KLIPNASLIENCTKAELGWMDF (SEQ ID NO: 109);
(xxvi) KLIPNASLIENCTKAELKGWMDF (SEQ ID NO: 110);
(xxvii) GALNNRFQIKGVELKSGWMDF (SEQ ID NO: 111); and
(xxviii) GALNNRFQIKGVELKSKGWMDF (SEQ ID NO: 112).

40. The lipopeptide according to any one of claims 1 to 39 capable of upregulating the surface expression of MHC class II molecules on immature dendritic cells (DC).

41. The lipopeptide of claim 40 wherein the DC are D1 cells.

42. A lipopeptide comprising a polypeptide conjugated to one or more lipid moieties wherein:

(i) said polypeptide comprises an amino acid sequence that comprises:

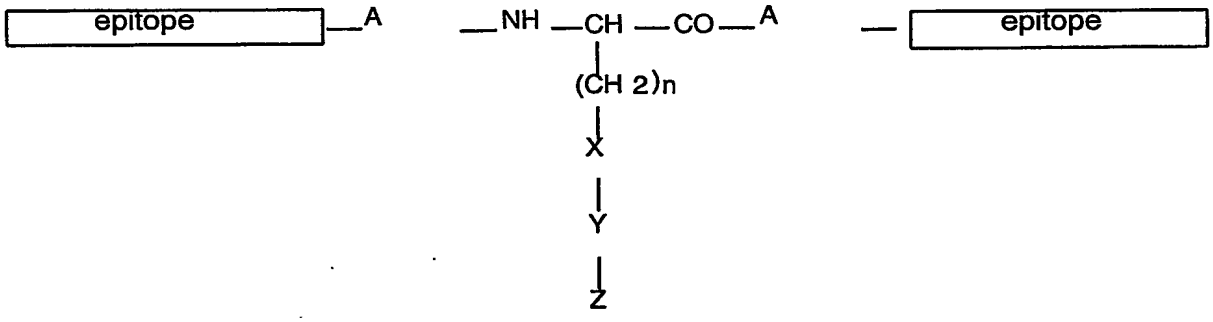
(a) the amino acid sequence of a T helper cell (Th) epitope and the amino acid sequence of a B cell epitope, wherein said amino acid sequences are different; and

(b) one or more internal lysine residues for covalent attachment of each of said lipid moieties via the epsilon-amino group of said one or more lysine residues;

(ii) each of said one or more lipid moieties is covalently attached to an epsilon-amino group of said one or more internal lysine residues; and

(iii) said lipopeptide has the general Formula (VI):

Formula (VI):



wherein:

epitope	is a T-helper epitope or B-cell epitope;
A	is either present or absent and consists of an amino acid spacer of about 1 to about 6 amino acids in length;
n	is an integer having a value of 1, 2, 3, or 4;
X	is a terminal side-chain group selected from the group consisting of NH, O and S;
Y	is either present of absent and consists of a spacer of about 1 to about 6 amino acids in length, wherein said spacer comprises arginine, serine or 6-aminohexanoic acid; and

Z is a lipoamino acid moiety selected from the group consisting of Pam_2Cys, Pam_3Cys, Ste_2Cys, Lau_2Cys, and Oct_2Cys.

43. The lipopeptide of claim 42 wherein A is absent.

44. The lipopeptide of claim 43 wherein the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 2 or SEQ ID NO: 3 or SEQ ID NO: 4.

45. The lipopeptide of claim 43 wherein: (i) the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 101; (ii) Y is present and consists of a serine homodimer; and (iii) Z consists of Pam_2Cys.

46. The lipopeptide of claim 45 wherein the T helper epitope comprises the amino acid sequence set forth in SEQ ID NO: 24 and wherein a lipid moiety is attached to the polypeptide via the epsilon-amino group of a lysine residue within SEQ ID NO: 24.

47. The lipopeptide of claim 45 wherein the lipid moiety is attached to the polypeptide via Lys-14 of SEQ ID NO: 24.

48. The lipopeptide of claim 43 wherein: (i) the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 102; (ii) Y is present and consists of a serine homodimer; and (iii) Z consists of Pam_2Cys.

49. The lipopeptide according to any one of claims 42 to 48 capable of upregulating the surface expression of MHC class II molecules on immature dendritic cells (DC).

50. The lipopeptide of claim 49 wherein the DC are D1 cells.

51. A method of producing a lipopeptide comprising:

(i) producing a polypeptide comprising an amino acid sequence that comprises:

(a) the amino acid sequence of a T helper cell (Th) epitope and the amino acid sequence of a B cell epitope, wherein said amino acid sequences are different; and

(b) one or more internal lysine residues or internal lysine analog residues; and

(ii) covalently attaching each of said one or more lipid moieties directly or indirectly to an epsilon-amino group of said one or more internal lysine residues or to the terminal side-chain group of said one or more internal lysine analog residues so as to produce a lipopeptide having the lipid moiety attached to the epsilon amino group of said internal lysine residue or having the lipid moiety attached to the terminal side-chain group of said internal lysine analog residue.

52. The method of claim 51 wherein the polypeptide is synthesized by a chemical synthesis means.

53. The method of claim 51 or 52 further comprising producing the lipid moiety.

54. The method of claim 53 comprising synthesizing the lipid moiety as a lipoamino acid.

55. The method according to claim 54 further comprising adding a spacer to the amino acid moiety of the lipoamino acid.

56. The method according to claim 55 wherein the lipid comprises an arginine homodimer or serine homodimer or 6-aminohexanoic acid .

57. The method of claim 55 or 56 comprising adding the spacer to the lipoamino acid via the terminal carboxy group in a process that comprises performing a condensation, addition, substitution, or oxidation reaction.

58. The method according to any one of claims 55 to 57 wherein the spacer comprises a terminal protected amino acid residue to facilitate conjugation of the lipoamino acid to a polypeptide.

59. The method of claim 58 further comprising de-protecting the terminal protected amino acid of the spacer and conjugating the lipoamino acid to a polypeptide.

60. The method of claim 54 comprising adding a spacer to a non-modified epsilon amino group of the polypeptide in a process comprising performing a nucleophilic substitution reaction.

61. The method of claim 60 wherein the polypeptide has an amino acid sequence comprising a single internal lysine or lysine analog residue and a blocked N-terminus.

62. The method according to claim 60 or 61 wherein the lipid comprises an arginine homodimer or serine homodimer or 6-aminohexanoic acid .

63. A composition comprising the lipopeptide according to any one of claims 1 to 50 and a pharmaceutically acceptable excipient or diluent.

64. The composition of claim 63 further comprising a biologic response modifier (BRM).

65. A method of eliciting the production of antibody against an antigenic B cell epitope in a subject comprising administering the lipopeptide according to any one of claims 1 to 50 or the composition of claim 63 or 64 to said subject

for a time and under conditions sufficient to elicit the production of antibodies against said antigenic B cell epitope.

66. The method according to claim 65 wherein the lipopeptide is administered intranasally to the subject.

67. The method according to claim 66 wherein the lipopeptide is administered to the subject by injection.

68. The method according to any one of claims 65 to 67 comprising eliciting the production of high titer antibodies.

69. The method according to any one of claims 65 to 68 wherein the antigenic B cell epitope is from a pathogen and wherein said method comprises generating neutralizing antibodies against the pathogen.

70. The method according to any one of claims 65 to 69 further comprising producing a monoclonal antibody against the antigenic B cell epitope.

71. A method of inducing infertility in a subject comprising administering to said subject a lipopeptide comprising a polypeptide conjugated to one or more lipid moieties, wherein:

(i) said polypeptide comprises:

(a) the amino acid sequence of a T helper cell (Th) epitope and the amino acid sequence of a B cell epitope of a reproductive hormone or hormone receptor, and wherein said amino acid sequences are different;

(b) one or more internal lysine residues or internal lysine analog residues for covalent attachment of each of said lipid moieties via an epsilon-amino group of said internal lysine or via a terminal side-chain group of said internal lysine analog; and

(c) each of said one or more lipid moieties is covalently attached directly or indirectly to an epsilon-amino group of said one or more internal lysine residues or to a terminal side-chain group of said one or more internal lysine analog residues; and

(ii) said lipopeptide is administered for a time and under conditions sufficient to elicit a humoral immune response against said antigenic B cell epitope.

72. The method of claim 71 wherein the lipopeptide is administered in combination with a pharmaceutically acceptable excipient or diluent.

73. The method of claim 71 or 72 wherein a secondary immune response is generated against the B cell epitope sufficient to prevent oogenesis, spermatogenesis, fertilization, implantation, or embryo development in the subject.

74. The method according to any one of claims 71 to 73 wherein antibody levels are sustained for at least a single reproductive cycle of an immunized female subject.

75. The method according to any one of claims 71 to 74 wherein the B cell epitope is derived from the amino acid sequence of luteinising hormone-releasing hormone (LHRH).

76. The method of claim 75 wherein the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 2 or SEQ ID NO: 3 or SEQ ID NO: 4.

77. The method according to any one of claims 71 to 76 wherein the T-helper epitope comprises an amino acid sequence as set forth in SEQ ID NO: 1 or SEQ ID NO: 24.

78. The method according to any one of claims 71 to 77 wherein the lipid moiety comprises a lipoamino acid selected from the group consisting of: (i) Pam_2Cys; (ii) Ste_2Cys; (iii) Lau_2Cys; and (iv) Oct_2Cys.

79. The method according to any one of claims 71 to 78 further comprising producing the lipopeptide.

80. The method according to any one of claims 71 to 79 further comprising determining the antibody level in a sample taken previously from the subject.

81. The method according to any one of claims 71 to 80 further comprising determining the fecundity of the subject.

82. A contraceptive agent comprising the lipopeptide according to any one of claims 1 to 50 wherein the B cell epitope is from a reproductive hormone or hormone receptor.

83. A contraceptive agent comprising the lipopeptide according to claim 44.

84. Use of the lipopeptide according to claim 44 in the preparation of a contraceptive reagent for reducing fertility in an animal subject.

85. A method of inducing an immune response against a Group A streptococcus antigen in a subject comprising administering to said subject a lipopeptide comprising a polypeptide conjugated to one or more lipid moieties, wherein:

(i) said polypeptide comprises:

(a) the amino acid sequence of a T helper cell (Th) epitope and the amino acid sequence of a B cell epitope of a Group A streptococcus antigen, and wherein said amino acid sequences are different;

(b) one or more internal lysine residues or internal lysine analog residues for covalent attachment of each of said lipid moieties via an epsilon-amino group of said internal lysine or via a terminal side-chain group of said internal lysine analog; and

(c) each of said one or more lipid moieties is covalently attached directly or indirectly to an epsilon-amino group of said one or more internal lysine residues or to a terminal side-chain group of said one or more internal lysine analog residues; and

(ii) said lipopeptide is administered for a time and under conditions sufficient to elicit a humoral immune response against said antigenic B cell epitope.

86. The method of claim 85 wherein the lipopeptide is administered in combination with a pharmaceutically acceptable excipient or diluent.

87. The method of claim 85 or 86 wherein a secondary immune response is generated against the B cell epitope sufficient to prevent the spread of infection by a Group A streptococcus and/or reduce morbidity or mortality in a subject following a subsequent challenge with a Group A streptococcus.

88. The method according to any one of claims 85 to 87 wherein the B cell epitope is derived from the amino acid sequence of the M protein of Group A streptococcus.

89. The method of claim 88 wherein the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 101.

90. The method according to any one of claims 85 to 89 wherein the T-helper epitope comprises an amino acid sequence as set forth in SEQ ID NO: 1 or SEQ ID NO: 24.

91. The method according to any one of claims 85 to 90 wherein the lipid moiety comprises Pam_2Cys.

92. The method according to any one of claims 85 to 91 further comprising producing the lipopeptide.

93. The method according to any one of claims 85 to 92 further comprising determining the antibody level in a sample taken previously from the subject.

94. A vaccine comprising the lipopeptide according to any one of claims 1 to 50 wherein the B cell epitope is from the M protein of Group A streptococcus.

95. A vaccine comprising the lipopeptide according to claim 45.

96. Use of the lipopeptide according to claim 45 in the preparation of a contraceptive reagent for reducing fertility in an animal subject.

97. A method of inducing an immune response against a gastrin peptide in a subject comprising administering to said subject a lipopeptide comprising a polypeptide conjugated to one or more lipid moieties, wherein:

(i) said polypeptide comprises:

(a) the amino acid sequence of a T helper cell (Th) epitope and the amino acid sequence of a B cell epitope of a gastrin polypeptide antigen, and wherein said amino acid sequences are different;

(b) one or more internal lysine residues or internal lysine analog residues for covalent attachment of each of said lipid moieties via an epsilon-amino group of said internal lysine or via a terminal side-chain group of said internal lysine analog; and

(c) each of said one or more lipid moieties is covalently attached directly or indirectly to an epsilon-amino group of said one or more internal lysine residues or to a terminal side-chain group of said one or more internal lysine analog residues; and

(ii) said lipopeptide is administered for a time and under conditions sufficient to elicit a humoral immune response against said antigenic B cell epitope.

98. The method of claim 97 wherein the lipopeptide is administered in combination with a pharmaceutically acceptable excipient or diluent.

99. The method of claim 97 or 98 wherein a secondary immune response is generated against the B cell epitope sufficient to prevent or block secretion of gastric acid in an animal in need thereof.

100. The method of claim 99 wherein the animal suffers from a condition selected from the group consisting of hypergastrinemia, Zollinger-Ellison syndrome, gastric ulceration, duodenal ulceration and gastrinoma.

101. The method according to any one of claims 97 to 100 wherein the B cell epitope is derived from the amino acid sequence of pentagastrin.

102. The method of claim 101 wherein the B cell epitope comprises the amino acid sequence set forth in SEQ ID NO: 102.

103. The method according to any one of claims 97 to 102 wherein the T-helper epitope comprises an amino acid sequence as set forth in SEQ ID NO: 24.

104. The method according to any one of claims 97 to 103 wherein the lipid moiety comprises Pam_2Cys.

105. The method according to any one of claims 99 to 104 further comprising producing the lipopeptide.

106. The method according to any one of claims 97 to 105 further comprising determining the antibody level against gastrin in a sample taken previously from the subject.

107. A vaccine comprising the lipopeptide according to any one of claims 1 to 50 wherein the B cell epitope is from a gastrin polypeptide.

108. A vaccine comprising the lipopeptide according to claim 46.

109. Use of the lipopeptide according to claim 46 in the preparation of a contraceptive reagent for reducing fertility in an animal subject.

110. The method according to any one of claims 65 to 70 wherein the antibody comprises an immunoglobulin selected from the group consisting of IgM, IgA, and IgG.

111. The method of claim 110 wherein the immunoglobulin is IgM.

112. The method of claim 110 wherein the immunoglobulin is IgA.

113. The method of claim 110 wherein the immunoglobulin is IgG.

114. The method of claim 113 wherein the IgG is selected from the group consisting of IgG1, IgG2a, IgG2b, and IgG3.